the ground, on Grand Vale Mountain, St. Elizabeth's, early in June.

57. *Diaperis*? (sp. nov.). Found at New Forest, near Alligator Pond, where the singular honey-combed limestone is the common rock. It was in December.

58. *Rhipiphorus* (sp. nov.). A single specimen taken in June, on the Hampstead Road: it was resting between two leaves of a shrub.

59. *Mordella* (sp.).

60. *Tenebrio* (sp.). Common under heaps of stones in Bluefields pasture.

61. *Upis* (sp. nov.).

62. *Attelabus* (sp. nov. very near *aureolus*, Klug). This pretty little insect was very numerous in June on the Hampstead Road, and it occurred also at the same season on Bluefields Mountain. We invariably found the specimens resting on the leaves of trees that overhung the road, and for the most part about ten or fifteen feet from the ground. They were apt to fall off on the slightest alarm. It has an odd appearance, as if it were but two-legged, from the great development of the anterior pair of legs. The spot on each elytron is golden during life, but after death fades to a dull drab hue.

[To be continued.]

XXVII.—*On the Habits and Geographical Distribution of* Bulimus, *a genus of Air-breathing Mollusks.* By Lovell Reeve, F.L.S.

The beautiful forms and varieties of shells produced by those air-breathing mollusks, which, under the generic appellation of *Bulimus*, constitute an important division of the great tribe of Snails, have become objects of especial interest to the conchologist, owing to the zeal with which a few enterprising scientific travellers have lately penetrated into tropical countries in pursuit of them. It is, however, to the productive exertions of Mr. Cuming that we are mainly indebted for the newer and more attractive species. The researches of this ardent naturalist in the arid plains on the west side of the Andes, in the dense woods of West Columbia and Central America, and more recently in the luxuriant open forests of the Philippine Islands, whilst they present an instructive contrast, exceed any result the most sanguine collector could have anticipated. In the dry and barren regions of Western Chili and Peru, the *Bulimi* are mostly small, and of comparatively fragile structure; but in the beautiful islands of the Eastern Archipelago, where climate and vegetation com-

bine to favour the growth of arboreal species, the genus is represented with prolific splendour. Mr. Cuming must have truly felt like one transported to the fabled garden of the Hesperides, when beholding the lofty trees of these sunny isles laden with snails of such magnificent proportions. Aladdin, in the Arabian tale, could not surely have contemplated the rich clusters of varicoloured fruit in the garden of the African Magician with more astonishment, nor probably gathered it with more avidity.

"It was in 1836," relates Mr. Broderip, "that Mr. Cuming proceeded to the Philippine Islands by permission of the Queen Regent of Spain, and aided by powerful recommendations from her government, which opened to him the interior of the islands, and caused him to be received with a noble hospitality, equalled only by the warm interest which facilitated his pursuits wherever he arrived and made himself known." Species of which we had but an imperfect knowledge, in consequence of the bad condition in which a stray individual chanced to reach our cabinets, were found in luxuriant plenty, and many new kinds were discovered in their airy solitude in equal abundance. Had De Férussac, the enthusiastic admirer of this tribe, lived to see the glorious series of *Bulimi* accumulated in the Cumingian collection in different stages of growth, and in the finest state of preservation, from the egg to the adult, he would have been indeed amazed.

The genus *Bulimus*, as restricted by Lamarck, comprehends an extremely natural group, though presenting important differences of growth and texture; and these variations are peculiarly local. In the Philippine Islands, the species are of large and rather solid growth, with a remarkable hydrophanous epidermis, that is, permeable by water or other evaporable fluid; on the barren hills of Lima, and in the sandy plains of Chili and Peru, they are mostly small and delicately formed; in Brazil, the species are remarkable for having the aperture in frequent instances denticulated; and in New Caledonia, Venezuela, New Granada and New Hebrides, they not uncommonly exhibit with equal peculiarity a plaited *Auricula*-like columella.

It is a curious feature in the Philippine species, that the varieties of pattern which constitute their chief ornament reside only in the epidermis. The colours of the shell rarely describe any sort of configuration; they are mostly blended into a uniform tint, over which a fanciful pattern is produced by the epidermis forming a double porous membrane in some places, and a single one only in others, developed, moreover, with the same continuous regularity as the textile marking of a Volute or Cone. This phænomenon is easily detected by immersing the shell in water, when the light portion, or upper porous layer, of the epidermis becomes saturated, and the ground colour of the shell is seen

through it; as the moisture evaporates, the epidermis resumes its light appearance. Sir David Brewster, in reply to a letter from Mr. Broderip on this subject, says: "It appears to me, from very careful observations, that the epidermis consists of two layers, and that it is only the upper layer which is porous, wherever the pattern is white. These white or porous portions of the epidermis differ from the other parts of the upper layer only in having been deprived of, or in never having possessed, the element which gives transparency to the membrane; in the same manner as hydrophanous opal has become white, from the expulsion of its water of crystallization."

There is little variety in the animal of *Bulimus*: the Chilian species are mostly of a light colour, and a few in this and the Columbian district are spotted, some having a transparent shell through which the spots are visible. The Philippine species are, without exception, of a sombre olivaceous brown, and dwell in family groups, as it were, among the shady foliage of the branches. Out of a group of some dozen living specimens, not more than three or four may be found in an adult state with the lip of the shell reflected. They may be dislodged by shaking the branches, but are chiefly disturbed by the heavy rains with which these islands are at times visited. Mr. Cuming preferred, however, to collect them in dry sunny weather, because he was sure of finding the objects of his search in their shady places of retreat. In the immense sandy tract on the west side of the Andes, the reverse of this condition of nature prevails. The *Bulimi* are here physically very distinct; some reside all the year round upon the numerous *Cacti*, but during the dry season, which lasts for several months, they live mostly in a state of torpor, inclosed within their shell by an epiphragm, and buried in the sand or under stones. On the approach of the dews they revive to a state of animation, and crawl about at night in quest of food.

In illustration of the remarkable drought that prevails in Northern Chili, and of its effect upon molluscous life, I am tempted to repeat, in brief, an anecdote related to me by Mr. Cuming. On the arrival of our friend at the port of Copiapo in 1829, he discovered the beautiful *Bulimus Broderipii* in considerable numbers, in the fissures of the rocks that may be seen here and there in the sandy plains of that country. Finding a large proportion of them dead, with the soft parts entirely decomposed, he requested a solitary inhabitant of the place to collect as many specimens as he could pick out alive, whilst he occupied himself in botanizing. Returning from his excursion, Mr. Cuming was greatly disappointed to find that among the quantity his Chilian collector had accumulated, there was scarcely one in a living state. Upon remonstrating with him for his inattention, the native re-

plied: "Only wait till the dews come, and they will be all alive again." Mr. Cuming rejoined: "I suppose you mean when it rains." The man, however, in perfect astonishment inquired what he meant; though a sexagenarian, he had never heard of such a thing as rain.

The *Bulimi* vary in their mode of propagation: fragile species with the lip of the shell simple are mostly viviparous, while those with a reflected lip are oviparous. The arboreal species of the Philippines deposit their eggs in little clusters on the trees, between two leaves which the animal manages to curl up, one upon the other, so as to form a receptacle for their protection; and so far as Mr. Cuming's observations go, they are all soft, like snakes' eggs, with the single exception of the *B. Mindoroensis*, in which instance the eggs are calcareous, deposited upon a leaf in parallel rows, each standing perpendicularly on end, attached at the base by a glutinous substance.

The habits of the *Bulimi* in the two widely-remote countries explored by Mr. Cuming having been treated of in the foregoing remarks, it only remains to speak of them in other parts. Turning to New Holland, we are unexpectedly surprised to find that the genus is there represented to an extremely limited extent. I am not aware of more than three species having been found in this wide expanse of country, although several fine *Helices* have been discovered; and in a region of which the Fauna and Flora exhibit so luxuriant and distinctive a character, the scarcity of a genus of so much importance in the Eastern Isles is remarkable. The same observation applies to New Zealand, from whence, so far as the interior of the islands of that group has been visited, no more than one or two species have been received. In Africa, the *Bulimi* are almost as great strangers as in the localities just spoken of; throughout the whole extent of land yet explored of this vast continent, scarcely a dozen species have been obtained. The *Bulimi* are here replaced by *Achatinæ*. Such a phænomenon may also be observed in some of the islands of the Pacific; in the Sandwich Islands the *Bulimi* are replaced by the genus *Achatinella*, and in the Society Islands their place is occupied by the *Partulæ*. In the West Indies the genera *Achatina* and *Glandina* seem to prevail. Howsoever abundant is the genus *Bulimus* in most of the islands of the Eastern Archipelago, few species appear to inhabit the great territories of India and China. On the coast of Borneo a beautiful one was recently discovered by Mr. Adams of H.M.S. Samarang by the accidental falling of a tree in a woody islet situated between Banguey and Balambangan; but they are of rare occurrence in that locality. In Europe, where nature is exposed to the vicissitudes of a colder climate, the *Bulimi* are mostly small, and exhibit no brilliancy of colour; so

also in the extensive district of North America, where no more than a few insignificant species are known to exist. It is in the richly fertile and woody district of Columbia that the genus *Bulimus* is represented with a magnificence little inferior to that of the Philippine Islands: here they are large enough and sufficiently abundant to be roasted and eaten by the aborigines, as a frequent article of food. Several fine species, entirely new to science, have been collected in Venezuela and New Granada by Mr. Linden, an assiduous botanical traveller, only within the last twelvemonth, at an altitude of 5000 to 8000 feet, and many more, no doubt, dwell in undisturbed solitude in the vast interior of that immense continent. It is extremely probable that a large portion of South America yet remains to be explored by the adventurous naturalist, inclosing a fine expanse of forest country, grand in extent, rich in foliage, and possessing all the elements favourable to the growth and beauty of arboreal mollusks.

XXVIII.—*Reports on the Progress of Physiological Botany.* No. 3. By Arthur Henfrey, F.L.S. &c.

On the Growth of Leaves.

In that remarkable book, Hales's 'Vegetable Staticks,' we find the account of an experiment made to determine the mode of growth and expansion of leaves. The method Hales adopted was to *tattoo*, as it may be called, young leaves with punctures made by means of a little instrument on which pins were fixed at determinate distances in parallel rows. In the fig-leaves on which he experimented he found that the punctures were separated from one another during the growth, but maintained their relative distances unaltered, and from this he concluded that "the growth and expansion were owing to the dilatation of the vesicles in every part." In his figures, however, it may be noticed that the leaf has grown more at the *borders and apex* than within the punctures.

Similar experiments have recently been made by M. Gaudichaud*, and he makes the following meagre statements in regard to the petioles and leaves. (The marks were made on young plants of the horse-chestnut raised from seed.) The marks made on the petioles increased their distance two or three times the diameters, equal or unequal, of the original measures, and the proportions of the upper parts generally exceeded those of the lower. It might be imagined that the blades of the leaves would be

* Comptes Rendus, May 10th, 1847.